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10/663,949	09/16/2003	Roswell J. Ruka	2003P07614US	3856
7590 11/15/2004			EXAMINER	
Siemens Corporation Intellectual Property Department 170 Wood Avenue South Iselin, NJ 08830			AUSTIN, MELISSA J	
			ART UNIT	PAPER NUMBER
			1745	

DATE MAILED: 11/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/663,949

Applicant(s)

RUKA ET AL.

Examiner

Melissa Austin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) 19-22 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-22 are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 September 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____.

DETAILED ACTION

1. It is noted that the original claims are misnumbered. Examiner has changed the numbering as follows (original: renumber) and will refer to the claims in this action based on the renumbering. The dependency of claims to misnumbered claims was also amended to reflect the renumbering.

1-18: 1-18; second 17: 19; second 18: 20; 19: 21; 20: 22

Election/Restrictions

2. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-18, drawn to a fuel cell, classified in class 429, subclass 12.
 - II. Claims 19-22, drawn to a method of manufacturing a fuel cell, classified in class 427, subclass 115.
3. Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the invention of Group I could be manufactured using a materially different process such as chemical vapor deposition, dip coating, molding, or printing.
4. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.
5. Because these inventions are distinct for the reasons given above and the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper.
6. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.
7. During a telephone conversation with Mr. John Musone on November 1, 2004 a provisional election was made without traverse to prosecute the invention of Group 1, claims 1-18. Affirmation of this

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election must be made by applicant in replying to this Office action. Claims 19-22 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

8. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Drawings

9. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: 30. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Information Disclosure Statement

10. The Information Disclosure Statement (IDS) filed on September 16, 2003 has been considered by the examiner.

Specification

11. The disclosure is objected to because of the following informalities:

Pg. 15, l. 4: "exhibits" should be "exhibit"

Pg. 16, l. 21: "provides" should be "provide".

Appropriate correction is required.

Claim Rejections - 35 USC § 112

12. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 7 is rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for 40% zirconia, does not reasonably provide enablement for 50% zirconia. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims. The specification states on page 15:

If too little nickel or too much zirconia is used, the fuel electrode tends to [exhibit] poor electrical conductivity...It has been found that a ratio of about 60% to about 85% nickel to about 40% to about 15% zirconia is suitable, without regard to optional dopants or additives, and preferably about 70% to about 80% nickel to about 30% to about 20% zirconia.

The specification limits the zirconia to a maximum of 40%, not 50% as claimed, and indicates possible disadvantages to using more than 40% zirconia.

Claim 13 is rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for 7 or 8 mole% yttria, does not reasonably provide enablement for 5 mole% yttria. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims. The specification states that a lower limit of 7-8 mole percent yttria in the yttria stabilized zirconia powder is suitable (Pg. 14, ll. 17-20). The specification does not enable 5 mole percent yttria in the yttria-stabilized powder.

13. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

14. The term "about" in claims 5-8, 10, 11 is a relative term which renders the claim indefinite. The term "about" is not defined by the claim, the specification does not provide a standard for ascertaining the

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requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. Regarding claims 5-8, the term "about" renders the fuel electrode composition indefinite. Regarding claims 10 and 11, the term "about" renders the composition of the nickel graphite powder indefinite.

15. A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. Note the explanation given by the Board of Patent Appeals and Interferences in *Ex parte Wu*, 10 USPQ2d 2031, 2033 (Bd. Pat. App. & Inter. 1989), as to where broad language is followed by "such as" and then narrow language. The Board stated that this can render a claim indefinite by raising a question or doubt as to whether the feature introduced by such language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims. Note also, for example, the decisions of *Ex parte Steigewald*, 131 USPQ 74 (Bd. App. 1961); *Ex parte Hall*, 83 USPQ 38 (Bd. App. 1948); and *Ex parte Hasche*, 86 USPQ 481 (Bd. App. 1949).

In the present instance, claim 6 recites the broad recitation at least about 70% nickel and at least about 20% zirconia, and the claim also recites at least about 60% nickel and at least about 15% zirconia, which is the narrower statement of the range/limitation.

In the present instance, claim 8 recites the broad recitation no more than about 85% nickel and no more than about 50% zirconia, and the claim also recites no more than about 80% nickel and no more than about 30% zirconia, which is the narrower statement of the range/limitation.

In the present instance, claim 11 recites the broad recitation at least about 70% nickel and at least about 20% graphite, and the claim also recites at least about 60% nickel and at least about 15% graphite, which is the narrower statement of the range/limitation.

In the present instance, claim 14 recites the broad recitation at least 5 mole percent of yttria, and the claim also recites at least 8 mole percent of yttria, which is the narrower statement of the range/limitation.

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16. Claims dependent from claims rejected under 35 USC 112, first and/or second paragraph are also rejected for the same.

Claim Rejections - 35 USC § 102

17. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

18. Claims 1-4, 12, 13, 15-17 are rejected under 35 U.S.C. 102(e) as being anticipated by Hui et al. (US 2004/0018409). Hui teaches:

Claim 1: a fuel cell comprising a cathode (applicant's air electrode), an electrolyte formed on the cathode, and an anode made of ceramic metal (applicant's ceramic-metal fuel electrode) plasma sprayed onto the electrolyte. (Pg. 1, [0011]; Pg. 4, [0042]; Examples 5 and 8)

Claim 2: a cathode composed of strontium-doped lanthanum manganite. (Pg. 1, [0011])

Claims 3 and 13: an electrolyte composed of yttria-stabilized zirconia; an example electrolyte layer formed of 7% yttria stabilized zirconia. (Pg. 1, [0011]; Example 5)

Claims 4 and 12: an anode composed of yttria stabilized zirconia and nickel. (Pg. 1, [0011])

Claim 15: a solid oxide electrolyte composed of yttria (applicant's rare-earth element) stabilized zirconia. (Pg. 1-2, [0015])

Claim 16: interconnects to connect adjacent individual cells in series to form a stack. (Pg. 1, [0006])

Claim 17: interconnects to connect adjacent individual cells in series to form a stack that functions as a fuel cell assembly (applicant's power generation system) including manifolds to conduct the reactants and products into and out of the stack. (Pg. 1, [0006])

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Claim Rejections - 35 USC § 103

19. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

20. Claims 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hui et al. (US 2004/0018409) in view of Clemmer et al. (*Processing and Properties of Porous Ni-YSZ Metal/Ceramic Composites*), as evidenced by INCO, Ltd. Hui teaches the elements of claim 4 as discussed in the above 35 USC 102 rejection, incorporated herein, but fails to teach that at least a portion of nickel in the fuel electrode is obtained from nickel graphite powder.

Clemmer teaches Ni/yttria-stabilized zirconia fuel cell anodes in which Ni-coated graphite particles (55% Ni content; obtained from INCO, Ltd.: Pg. 233) were used as a starting material. Generally, the anodes created from the Ni-coated graphite particles had a lower coefficient of thermal expansion and higher electrical conductivity for a given Ni loading compared to the anodes made of separate Ni and graphite particles. The hybrid structures had intermediate values of coefficient of thermal expansion and electrical conductivity. (Abstract)

Nickel coated graphite particles available from INCO contain either 60 or 75% (www.incosp.com).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used Ni-coated graphite particles, such as those available from INCO, as a starting material for Ni/yttria-stabilized zirconia fuel cell anodes as taught by Clemmer in the fuel cell as taught by Hui in order to achieve lower coefficient of thermal expansion and higher electrical conductivity for a given Ni loading.

21. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hui et al. (US 2004/0018409) in view of Cable et al. (5,589,285). Hui teaches the elements of claim 13 as discussed in

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the previous 35 USC 102 rejection, incorporated herein. However, Hui fails to disclose an yttria stabilized zirconia powder containing at least 8 mole percent yttria.

Cable teaches an SOFC with a cathode containing lanthanum manganate (Col. 7, l 66 – Col. 8, l 2), an electrolyte of zirconia stabilized with 8 to 10 mole percent yttria (Col. 8, ll. 12-14), and an anode containing a nickel powder mixed with zirconia (Col. 10, ll. 18-20). This electrolyte is substantially impervious to gases (preventing poisoning of the cathode by fuel) but ionized oxygen can migrate through the electrolyte under the influence of an applied oxygen potential (Col. 8, ll. 16-18).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used zirconia stabilized with 8 to 10 mole percent yttria as taught by Cable in the fuel cell as taught by Hui in order to provide an electrolyte substantially impervious to gases, thus preventing poisoning of the cathode by fuel, but through which ionized oxygen can migrate under the influence of an applied oxygen potential.

22. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hui et al. (US 2004/0018409) in view of Cable et al. (5,589,285). Hui teaches the elements of claim 1 as discussed in the previous 35 USC 102 rejection, incorporated herein. Hui also teaches an interlayer (applicant's precursor layer) formed by thermally spraying an interlayer with a thickness of 5-20 μ m on the electrolyte before depositing the electrode on the electrolyte (Pg. 1-2, [0015], Pg. 4, [0041]). However, the reference fails to teach that the interlayer contains zirconia.

Cable teaches an SOFC with a cathode containing lanthanum manganate (Col. 7, l 66 – Col. 8, l 2), an electrolyte of yttria-stabilized zirconia (Col. 8, ll. 12-14), and an anode containing a nickel powder mixed with zirconia (Col. 10, ll. 18-20). Between the electrolyte and anode, an interfacial layer (applicant's precursor layer) containing sulfur tolerant material is disposed (Col. 3, ll. 1-3); the interfacial layer may contain Y-doped ZrO_2 (Col. 10, ll. 1-4; applicant's zirconia). The thickness of the interfacial layer is generally 1-100 μ m, preferably less than 50 μ m (Col. 8, ll. 35-37). The interlayer serves to improve electrical contact between the electrolyte and anode and provides an environment in which the species

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can interact or react because the interlayer keeps sulfur from the fuel from poisoning the anode, particularly Ni/YSZ cermet anodes (Col. 8, ll. 19-34; Col. 6, ll. 55-63; Col. 18, ll. 23-29).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have made the interlayer between the anode and the electrolyte of the fuel cell as taught by Hui with Y-doped zirconia as taught by Cable in order to improve electrical contact and provide an environment in which the species can interact or react.

23. Claims 5-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hui et al. (US 2004/0018409) in view of Jensen (5,035,962). Hui teaches the elements of claim 4 as discussed in the previous 35 USC 102 rejection, incorporated herein. However, Hui fails to disclose the composition of the fuel electrode.

Jensen teaches a fuel electrode for an SOFC having a graded composition structure formed by successively depositing layers of nickel-yttria stabilized zirconia mixtures with different compositions (Col. 3, ll. 6-9). Tables 1 (Col. 9) gives the compositions of the layers on a volume basis. In order to convert the volume percentages to weight percentages, the following formula was used:

$$\text{Weight}\%_j = \frac{\text{Vol}\%_j (\text{Vol}_j + \text{Vol}_k) \rho_j}{[\text{Vol}\%_j (\text{Vol}_j + \text{Vol}_k) \rho_j] + \text{Vol}\%_k (\text{Vol}_j + \text{Vol}_k) \rho_k} = \frac{\text{Vol}\%_j \rho_j}{[\text{Vol}\%_j \rho_j + \text{Vol}\%_k \rho_k]}$$

The densities used were obtained from www.matweb.com for yttria stabilized zirconia and nickel. The following table lists the weight percents corresponding the volume percents of Jensen's Table 1.

	Volume percent ZrO₂	Weight percent ZrO₂	Volume percent Ni	Weight percent Ni
Layer 1	70-90	63-87	10-30	13-37
Layer 2	40-60	33-53	40-60	47-67
Layer 3	10-30	7.6-24	70-90	76-92.3

As can be seen from the table Jensen teaches minimums of about 60% Ni and about 15% YSZ (claim 5) and about 70% Ni and about 20% YSZ (claim 6). Jensen also teaches maximums of about 85% Ni and about 50% YSZ (claim 7) and about 80% Ni and about 30% YSZ. The compositions of the individual layers of the multiple layer graded structure approximate a layer in which the composition is continuously graded from being high in zirconia at the electrolyte interface to being high in nickel at the external

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surface of the anode and meets the simultaneous requirements of adhesion of the yttria stabilized zirconia electrolyte and adequate electrode electrical conductivity.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the fuel electrode compositions as taught by Jensen in the fuel cell as taught by Hui in order to meets the simultaneous requirements of adhesion of the yttria stabilized zirconia electrolyte and adequate electrode electrical conductivity.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Melissa Austin whose telephone number is (571) 272-1247. The examiner can normally be reached on Monday - Friday, 7:15 AM - 3:45 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

mja

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